Salmon Habitat Recovery Project Prioritization Strategy

For

Water Resource Inventory Area 1

(Version 1.1)

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WRIA 1 SALMON HABITAT RECOVERY STRATEGY

Introduction

This document describes a strategy for restoring habitats essential to the recovery of Endangered Species Act listed chinook salmon and bull trout along with other salmonids native to Water Resource Inventory Area (WRIA) 1. The strategy emphasizes projects that identify and promote restoration of natural habitat forming processes while recognizing that the ultimate recovery of specific salmon stocks will be the product of combined local, state, and regional efforts. It is recognized that habitat recovery will only be meaningful if fish production from those habitats also recovers to support fish population recovery goals. The geographic scope of this strategy is WRIA 1.

WRIA 1 encompasses the Nooksack River watershed, the adjacent drainages that enter the Strait of Georgia, and Bellingham, Chuckanut, the north portion of Samish Bay, portions of the Sumas and Chilliwack River watersheds that are in the U.S., and the associated estuarine, nearshore, and marines areas (Figure 1). Strategies and priorities in this document are consistent with the policy direction outlined in the "Wild Salmonid Policy" (WFWC, 1997) adopted by the Washington Fish and Wildlife Commission and approved by Lummi Nation and Nooksack Tribe. These three entities collectively constitute the salmon co-managers for WRIA 1. This strategy provides a workable local framework for salmon habitat recovery project planning and implementation pending completion and approval of the Shared Strategy for Recovery of Salmon in Puget Sound (http://www.sharedsalmonstrategy.org) and revision or implementation of related local governmental policies, plans, regulations, and programs.

This strategy contains two major components: (1) salmonid stock priorities as determined by the salmon co-managers (Lummi Nation, Nooksack Tribe, Washington Department of Fish and Wildlife); and, (2) a watershed restoration strategy. In addition, attachments are provided that may be updated for specific grant sources or cycles. The purpose of the attachments is to assist in application preparation and ranking. Attachment A contains directions for project applicants regarding Lead Entity supplemental information. Attachment B presents the current scoring matrix to be used by the Salmon Habitat Restoration Citizens Advisory Committee for project ranking. Attachment C contains a listing of WRIA 1 Information and Restoration Group Resources. Attachment D contains an annotated bibliography of existing information for WRIA 1. Finally, Attachment E contains the Lead Entity (LE) schedule for submission and review of applications for the most current State of Washington Salmon Recovery Funding Board grant cycle.

This strategy provides a tool to guide WRIA 1 local governments, the salmon co-managers, and others as they evaluate day to day operations and associated regulations that affect habitat conditions and habitat restoration. It is anticipated that this document, and subsequent versions, will provide the foundation necessary to guide WRIA 1 fish habitat restoration priorities and recovery project selection, local recovery plans that will "roll-up" into the Shared Strategy for Recovery of Puget Sound Salmon, and watershed management planning under ESHB 2514. The strategy is drawn in large part from materials prepared for a co-manager Nooksack chinook

recovery plan and it is the intent for this strategy to be consistent with the policy goals and objectives contained in the "Wild Salmonid Policy" and, for federal lands, the aquatic conservation strategy of the President's Northwest Forest Plan (USDA and USDI, 1994). The strategy will continue to be periodically updated to incorporate new information and analysis regarding habitat limiting factors and regional recovery goals and priorities.

Salmonid stock priorities are identified below, in **STOCK PRIORITIES**. Projects will be evaluated and ranked on the ability to protect and restore important habitats, habitat forming processes, both biological and physical, and/or refine knowledge of important factors and habitat functions that limit salmonid production within WRIA 1. Geographic areas that correlate with known habitat limitations for important lifestages of North and South Fork Nooksack native early chinook stocks are identified in Table 1.

STOCK PRIORITIES

The watershed restoration strategy assigns the highest stock priority to assessment of biological limiting factors, and to habitat protection and restoration projects, - which positively impact the recovery and production of the affected species and populations in the following order: (1) South Fork native early chinook salmon; (2) North Fork native early chinook salmon (includes Middle Fork); and (3) Nooksack bull trout (native char); (4) Nooksack wild spawning coho salmon; (5) Nooksack native fall chum salmon; and, (6) Nooksack pink salmon. Important to ecological restoration, but not prioritized at this time, are winter and summer-run steelhead, sea-run cutthroat trout, naturally reproducing populations of fall chinook (if present), sockeye, and other resident native salmonids. Project ranking criteria are designed to reflect these stock priorities.

Specific population recovery goals for chinook are being developed by the salmon co-managers, and by NMFS, and will be included in the Shared Strategy when completed. These population goals will provide restoration targets for listed and some or all of the stocks identified above. The relative stock priorities identified here will be revised periodically by the salmon co-managers when sufficient new information is available and warrants consideration of possible changes warrant consideration.

WATERSHED RESTORATION STRATEGY

Introduction

Restoration can be generally defined as the "reestablishment of the structure and function of an ecosystem, including its natural diversity" (Cairns 1988 and NRC 1992 as cited in Williams et al. 1997). To be effective, watershed-scale restoration must be long-term, comprehensive, process-oriented, guided by best available science, and adherent to the principles of ecological restoration and adaptive management. While modification and enforcement of land use regulations may halt or slow watershed decline, active restoration will be necessary to reverse the decline and redirect the trajectory towards historic ecosystem structure and function (Williams et al. 1997). The scope of this watershed restoration strategy embodies the principles that already guide the active,

voluntary restoration projects on-going in WRIA 1. These projects integrated and built upon past and present salmon recovery projects and planning. The same basic principles have guided the Nooksack Recovery Team since its inception in 1994 and its individual members since the early 1980's.

The NRT was formed as a non-profit organization in 1994 to provide a restoration forum in which those interested in watershed recovery could coordinate and collaborate. The NRT has succeeded in bringing a broad cross-section of groups working on restoration together on a regular basis to solve problems, share resources, and plan salmon restoration activities and public education opportunities. Examples of NRT members active at the project level include: Bellingham, Crown Pacific, Lummi Nation, Nooksack Tribe, Nooksack Salmon Enhancement Association (NSEA), Northwest Ecosystem Alliance, Trillium Corp., U.S. Forest Service, Whatcom County, Whatcom Conservation District, Washington Departments of Ecology, Fish and Wildlife, and Natural Resources, Washington Trout, and the U.S. Forest Service. These groups have proven effective in working together and provide an established structure to "get-the-job-done" for watershed restoration. The strategy provides a framework to guide NRT and others towards habitat projects that address restoration priorities in a logical sequence.

The functional principles guiding NRT member projects reflect an emphasis on assessing the need for and then implementing projects that protect habitat that is still functioning properly, treating problems by addressing their physical or biological sources, and restoring habitat functions where the root causes are well enough understood to have reasonable confidence in achieving the intended objective. A number of projects completed over the years and recorded in the NRT Project Database (2001) reflect this basic approach. Fish population and habitat studies are necessary to identify the "limiting factors" that may restrict salmon production from a given river system. A number of studies and reports including the Salmon and Steelhead Stock Inventory (SASSI, 1992), Salmon Habitat Inventory and Assessment Project (in-progress) and annual spawner surveys and smolt counting contribute to our fish population knowledge in WRIA 1. Existing habitat studies, such as those conducted during the 1980's (e.g. Schuett-Hames and Schuett-Hames, 1987; Schuett-Hames et. al., 1988; Schuett-Hames, Schuett-Hames, and Mike, 1988), helped shape a basic understanding of habitat factors that limit production of chinook and other salmonid species and guided some of the early habitat protection and restoration projects in the basin. These and other information sources are being synthesized into a comprehensive document under the auspices of the Washington Conservation Commission and its WRIA 1 Limiting Factors Report anticipated to be completed in late 2001 or early 2002.

The Whatcom Land Trust (WLT), Whatcom County, Lummi Nation, Nooksack Tribe, and others have used data such as these along with independent analysis to guide acquiring key land parcels to further WRIA 1 watershed protection objectives. Examples include: the WLT and County Parks parcels along critical chinook holding and spawning habitats within the Saxon to Acme reach of the South Fork; the Lummi Nation/The Nature Conservancy Arlecho Creek partnership, also in the South Fork; and the Washington Department of Fish and Wildlife Marietta Slough project in the Nooksack estuary.

Road and landslide inventories from the "Peak Report" (PEAK, 1986) documented a correlation between land-management activities and increased sediment production to, and damage of, fish habitats and have been an essential tool in the prevention of further impacts. Study results produced specific corrective actions (road obliteration, abandonment, drainage upgrades, etc.) for problem roads on National Forest, state, and private timber lands. Subsequent road, landslide and County road culvert inventories for the Nooksack upstream of Deming (e.g. Watts, 1996, 1997; Zander, 1996, 1997; Zander and Watts, 1998; Whatcom County, in preparation) have provided a more complete picture and guided extensive road drainage improvement, landslide hazard reduction, abandonment, and fish passage restoration activities. Similar work is also occurring in other drainages such as a road maintenance needs assessment for upper Anderson Creek (Zander, 2001).

The inclination of local restoration partners has been to only undertake major in-channel projects once sufficient assessment information is available. An example of this is the Larson's historic scale log jams installed during the summer of 2001 in the upper South Fork Nooksack River. The jam installation is the product of data collection and analysis of fish utilization, current and historic habitat condition, riparian function, and the geomorphic history of the project reach and surrounding watershed dating to the early 1980's. These data guided project objectives, design, and implementation and provide performance measures for project monitoring.

These projects serve as examples of the restoration foundation upon which WRIA 1 habitat recovery is built. The strategy outlined below provided a framework to strategically guide recovery into the future using best available science and the multiple talents of WRIA 1 restoration partners.

Goals

The primary goals of the interim WRIA 1 watershed restoration strategy are to assess and address biological limiting factors, protect properly functioning habitats, and restore and maintain to within the range of natural variability the landscape processes that form habitats to which wild salmonid stocks are adapted. Since funding is limited, prioritization is necessary to focus and direct restoration efforts in the near term towards recovery of the species most at risk, i.e. ESA-listed species. Over the long term, prioritization merely alters the sequence, rather than the types, of restoration projects (Beechie and Bolton 1999). Further, adopting a process-oriented approach based on a sound scientific understanding of the biological and physical processes limiting salmonid production ensures benefits to multiple species, even while benefits to priority species are maximized.

Since restoration must be implemented and evaluated at the watershed scale and over long time frames, institutionalization of restoration into communities and agencies will be necessary (Williams et al. 1997). Thus, the secondary goal is to encourage the establishment of coordinated watershed restoration programs through: (1) encouraging partnerships of restoration practitioners, resource managers, landowners and community stakeholders (e.g. Nooksack Recovery Team and Marine Resources Committee); (2) increasing knowledge, information and tools for watershed restoration and management; and (3) providing opportunities for community-based employment, training, education and stewardship.

Objectives

The objectives of this watershed restoration strategy are to: (1) identify the ecological principles that should guide restoration planning; (2) provide general guidelines for specific watershed restoration activities; (3) provide the framework for the sequence of steps necessary to develop a watershed restoration plan, including development of the adaptive management mechanism; (4) identify appropriate funding mechanisms to meet project priorities and to encourage active support and participation by the community ; (5) outline an early action watershed restoration strategy targeted at Nooksack native chinook and other listed and non-listed salmonids according to the stock priorities identified above.

Principles of Watershed Restoration

This strategy is built upon the following principles of ecological restoration:

Focus on disruptions to habitat-forming processes. Restore ecosystems upon which endangered species, and other priority salmonids, depend by addressing the root causes, rather than symptoms, of watershed degradation. By restoring the natural rates and magnitudes of habitat-forming processes, habitat conditions will naturally tend to express the array of habitat conditions to which local stocks are adapted (Beechie and Bolton 1999). Historical reconstruction is key to identifying disruptions to habitat forming processes. Implicit in the process-oriented approach is the move away from managing for static habitat conditions, instead restoring natural ranges of temporal and spatial variability in habitat conditions. For instance, natural channel migration may cause degradation of a side channel in one location while allowing for creation of similar habitats in other locations. Examples of projects that address disruptions to habitat-forming processes include: riparian restoration, sediment source reduction through road drainage improvement or abandonment, removal of riprap and levees to provide for channel migration, or restoring access to former habitat.

Provide for life history-stage specific refugia and connecting habitats throughout the watershed. It is important to consider the effects of habitat fragmentation, where functional habitat patches decrease in size and become isolated from one another, reducing the value of remaining habitat. High quality (fully functional) habitat should be protected first, followed by protection and/or restoration of habitats contiguous or near to existing high quality habitats. In the short-term, presence of such refugia should help stabilize the population, while in the long-term, refugia can provide colonists to the rest of the basin (Beechie & Bolton 1999). Further, protection of fully functional habitat is both cheaper and more likely to succeed than restoring degraded habitats (Hoobyar 1999). For example, restoration of degraded habitats in the lower Mainstem Nooksack will be necessary to ensure connectivity between habitat types. A phased approach to restoration may be more appropriate in such habitats, concentrating at first on actions that will change the trajectory towards recovery (i.e. riparian restoration initially emphasizing removal of exotic species and the establishment of a mixed forest canopy before selecting for conifers as a primary riparian stand component). However, the phasing should recognize that ultimately native conifers would probably result in the most desirable restoration trajectory of providing

large volume LWD that is needed to create and maintain habitat-forming processes in large channels.

Prioritize projects that protect and restore full function. For any specific acquisition, sufficient conservation easements or property should be acquired to adequately protect and restore natural stream functions (e.g. meander belts for floodplain reaches). While it may be difficult or impossible to accomplish this on a single parcel through acquisition of fee simple ownership or a conservation easement, this objective can be achieved through a systematic approach that achieves this objective over the shortest time period feasible. In addition, greater consideration should be given to projects that restore a greater level of habitat function. For example, riparian projects where 150-foot buffers are proposed for restoration versus another proposal on a similar stream for which 50-foot buffer is proposed. The project that will provide the greatest demonstrable function should be given greater consideration.

Prioritize critical habitat to priority species. Priorities: (1) habitat currently used during important life stages (i.e. holding, spawning, summer juvenile rearing and winter juvenile rearing for chinook, estuary areas used by smolts during the freshwater to marine transition); (2) connecting habitats used for upstream migration (3) reaches that are naturally inaccessible, but, physically and/or hydrologically connected to reaches which chinook actually use and which are important for critical watershed processes; (4) habitat formerly accessible but still in functional condition and for which access can be restored (see Table 1). Where bottlenecks are discovered at particular life history stages, restoration of such habitats is the highest priority (Beechie and Bolton 1999). Priorities need to consider the quantity as well as quality of habitat that will benefit from restoration. These geographic priorities reflect a paucity of knowledge regarding use and potential limitations of marine habitats within WRIA 1. The priorities may be modified in the future should additional information become available that warrants such changes.

Symptoms (rather than causes) of degradation should be treated only as interim measures. Habitat modifications (e.g. placing log structures and constructing spawning riffles) have experienced high failure rates in the past (Frissell and Nawa 1992), likely due to failure to consider the ecological and landscape contexts of habitat degradation (Beechie and Bolton 1999). Instream projects (e.g. engineered debris jams, habitat structures, channel excavation) may be constructed as interim measures when stocks are critically low, but such projects should both be preceded by detailed assessment and conducted in conjunction with treatment of long-term effects (e.g. riparian revegetation, forest road abandonment). These assessments should consider those biological and physical factors that are beyond the project scope and that may affect the ability to evaluate project effect on improved biological functions. Such habitat modifications may be more feasible in smaller streams and less so in streams with elevated sediment loads, high peak flows, or highly erodible bank materials (Frissell and Nawa 1992). Similarly, carcass deployment is an interim measure to return to stream ecosystems marine derived nutrients, which were historically high due to large anadromous salmonid runs.

Employ critical pathways methodology. Projects are typically designed and implemented over relatively small temporal and spatial scales, yet there is a need to understand the larger spatiotemporal context, especially if several projects are planned for a sub-basin. Therefore, assessment and restoration planning needs to be coordinated at least at the reach, and preferably at the sub-basin, scale. Assessment should focus on the biological, hydrologic and geomorphic processes that may affect project success. For example, high summer stream temperatures in the

South Fork Nooksack River are a symptom of many factors including changes in channel morphology (e.g. channel widening) that resulted from land management-related sedimentation, harvest of mature riparian forests, changes in hydrology such as losses of floodplain wetlands, water use, and removal of in-channel large woody debris. Replanting riparian areas is an important step towards re-establishing shade and lowering stream temperatures but may be ineffective if undertaken without restoring natural rates of sediment delivery, transport, and storage, and maintaining adequate instream flows for salmon.

Maximize cost-effectiveness. In order to maximize efficient use of limited funds, project cost-effectiveness is an important consideration. Development of formal cost-benefit ratios may be limited by difficulties in quantifying and comparing true costs and realized benefits, but comparison of absolute costs is useful for relative comparison of projects.. Also important is the extent to which, and over what time scales, current land use regulations and/or natural habitat recovery will afford similar benefits and with what associated opportunity costs.

Maintain, monitor, and adaptively manage. Use best available science to design, implement and maintain the project, monitor and evaluate project success, and employ adaptive management principles, including periodic review and revision of geographic priorities, stock priorities, and best restoration practices.

Activity Guidelines (NMFS 2000)

Information for conducting watershed restoration projects can be found in many sources including the technical peer review literature. The References Cited, and the WRIA 1 Salmon Recovery Resource List may also be available to help assist in project development. The latter two can be found in Attachment C.

In general, "hands on" active watershed restoration activities should follow the habitat restoration guidelines and technical manuals referenced in "A Citizen's Guide to the 4(d) Rule" (NMFS 2000). Assessment studies should use standardized methodologies where they exist, or be designed by qualified experts with appropriate technical background and credentials.. The intent of this strategy is to encourage assessment and habitat restoration projects that are well designed and which provide appropriate technical documentation to demonstrate how the project will protect and restore priority species. Projects that are thorough in design and clearly linked to restoration objectives and priorities may also have the added advantage of successfully negotiating the local, state, and federal permitting processes. It will be essential that sufficient time for acquiring the necessary permits be provided for in project timelines. All instream work is likely to require Federal agency project review, and proposed timelines and designs need to anticipate this.

Sequencing of Watershed Restoration

The sequence of necessary steps outlined below are adapted from Williams et al. (1997) and Beechie and Bolton (1999).

Early action strategy: Use existing data and expert opinion to identify critical habitats for various life history stages of North and South Fork chinook stocks (see Table 1). Such habitats

should be targeted for protection and restoration. The fish distribution maps (WCD and others, 2001), watershed analyses, and other assessment reports can be used as interim guides (see resource list). The WRIA 1 Limiting Factors report (expected in late 2001 or early 2002) will be an important synthesis of existing information and data needs. In addition, data from ongoing studies will be incorporated in future versions of this strategy as the information becomes available.

Establish historical (and/or pristine) processes and conditions. "Evolutionary context is essential to defining objective restoration goals; historical data often reveal ecological conditions that now are rare or unrecognized, but that help establish restoration goals" (Angermeier 1997). Pristine habitats in the watershed, where they exist, or other watersheds in the region may provide a surrogate where historical data are lacking. The objectives of this step are to determine the range of natural conditions to establish what is within the realm of natural variability, and to estimate natural rates of habitat-forming processes (Beechie and Bolton 1999).

Understand Human impacts and Limiting Factors. Understanding what processes are causing habitat degradation and how those processes can be reversed is key to any watershed strategy (Frissell 1997). The WRIA 1 Limiting Factors Report (WCC, in preparation) will collate existing data on general physical and biological factors limiting salmonid production, but quantification of critical habitat parameters is necessary to identify or refine our understanding of bottlenecks to salmon production. Implicit in this step are basinwide inventories of current habitat condition and use. Assessment of changes in rates of habitat-forming processes due to land use activities is also necessary.

Develop Final Watershed Restoration Plans (by Sub-Basin). Identify actions required to restore habitat-forming processes and key biological functions. For example, inventory blockages to passage, inventory road failure hazards, map riparian areas to thin or replant, identify floodplain habitats that can be reconnected or areas where dikes/riprap could be setback or removed to restore floodplain function, or areas where salmon carcass placement may be beneficial. The geographic priorities are identified in Table 1. Priorities will be redefined as necessary pending completion of the WCC limiting factor report for WRIA 1 and other on-going analyses.

Evaluate probable improvement in local biological indicators for each task. Projects must be evaluated using the best mix of quantitative and qualitative methods available (best available science). It is essential that the evaluation identify those physical (e.g. large woody debris, substrate size, temperature) or biological attributes (e.g. benthic macroinvertebrate diversity, hatchery outplants) that the project will affect and those attributes beyond the project scope that may affect project success. For example, placement of designed historic scale log jams may produce measurable physical habitat benefits to pool volume and habitat complexity yet utilization by rearing juveniles may not increase if the system is chronically under-seeded. Specific analyses that demonstrate the cause/effect relationship for watershed restoration projects are essential information as the local salmon co-managers (Lummi Nation, Nooksack Tribe, and Washington Department of Fish and Wildlife) assess limitations to fish production.

Prioritize actions based on costs and potential improvement in biological indicators. Use a cost-benefit ratio analysis or other defensible analysis, and/or establish the sequence of actions that are likely to produce the shortest recovery time for the priority stock.

Estimate costs. Estimate the total costs of a restoration project or package, identify appropriate cost shares and in-kind contributions, and seek funding sources.

Implementation. Implement watershed restoration projects after sufficient assessment and design and using best available science.

Monitor and evaluate restoration success (ongoing). Monitor and evaluate individual projects, input data into centralized database (i.e. NRT Project database, 2001), incorporate lessons learned into new restoration projects.

Adaptive management feedback loop. The local chinook recovery and watershed management planning efforts and this strategy provide a framework for adaptive management monitoring that is integrated into a WRIA-scale decision support system (DSS). The Joint Technical Advisory Committee (JTAG) operating under the auspices of the salmon co-managers and Whatcom County will review monitoring data and coordinate the integration of these data into the DSS as appropriate. JTAG will use assessment data to make recommendations to modify methods, target specific geographic areas, and make refinements to the limiting factors analysis and the watershed restoration strategy. In addition, the Nooksack Recovery Team (NRT) holds monthly meetings of watershed restoration personnel and hosts a yearly watershed symposium (Salmon Summit) to both share information and tools for successful restoration and to engage the community in salmon restoration.

Sources of Funding

The ability to provide project matching funds, in-kind services, and administrative support has been key to optimizing the scarce grant resources available for salmon recovery. The salmon recovery cooperators of WRIA 1 were able to provide an average match of 43 percent for the Early 2000 SRFB funding submissions and typically exceed grant match requirements by a substantial amount. This large match reflects the high level of cooperation and collaboration among those working on salmon recovery in WRIA 1. The list below provides an overview of possible sources of funding and match available to project proponents.

- Apply for state/federal agencies and private grants (e.g. Salmon Recovery Funding Board, U.S. Fish & Wildlife Service's Jobs-in-the Woods, Centennial Clean Water Fund, Bureau of Indian Affairs, National Fish and Wildlife Foundation).
- Solicit volunteers in cooperation with skilled local groups such as the Nooksack Salmon Enhancement Association (WDFW's designated regional fisheries enhancement group) or Nooksack Recovery Team.
- Use existing public and private infrastructure including technical and administrative staff time and heavy equipment resources.
- Work with landowners that are able to provide project match through direct coverage of project costs, through designation of conservation easements, donations of materials, or donations of equipment time.
- Identify local sponsors (e.g. Whatcom County, City of Bellingham, NSEA) capable of funding Washington Conservation Corps crews targeting restoration projects

including riparian replanting and plant maintenance, instream structure placement and assessing fish passage at road culverts.

Project Ranking

This strategy is designed to: (1) maximize benefits to the top two priority stocks, North Fork and South Fork native early chinook, using the best existing information available; and (2) to assist in the on-going transition from what has often been an opportunistic approach to project identification and implementation and move towards more strategic watershed restoration planning

Required Elements

- Eligibility (i.e. ineligible if there is legal obligation to perform proposed work; subject to funding agency requirements)
- Monitoring and evaluation of project success
- Stewardship plan (site maintenance and management)
- Benefits to one or more of the stocks listed in interim stock priorities
- Certainty of success (i.e. is project well designed and documented with clearly identified and measurable objectives)

Ranked Elements

Benefit to Priority Species. Projects conducted in areas identified in Table 1 must explicitly address interim habitat factors for decline and demonstrate clear linkages with benefits to species both targeted and affected.

Consistency with sequencing. Maximum points are assigned to those projects that protect and restore most functional habitats, followed in order of decreasing priority by projects involving (1) filling critical data gaps necessary to identify bottlenecks, (2) restoration of less functional habitats, (3) assessment as part of final watershed plan

Consistency with strategy. How well does project address root causes of watershed and habitat degradation? To what extent has critical pathways methodology been employed? Is project contiguous to other functional/protected areas? To what extent will natural stream habitat functions be fully restored, instead of partially restored?

Time scale of benefits. Are benefits immediate or mid to long term and what is the expected useful life? What are the assurances over time that the benefits will persist (e.g. 15 - year lease, conservation easement, outright purchase, LWD recruitment potential, etc.).

Likelihood of success. Does the project use proven methods and are applicable plans and designs available for review? What is the readiness to conduct the work (design complete, permits obtained)? Is the entity conducting restoration or assessment appropriately qualified? Is the conceptual design likely to enable permits? Is the project in the lower ends of the recovery

trajectory (i.e. heavily degraded habitats that are more difficult to restore to full function) or does the project protect or restore habitats that approach properly functioning conditions?

Cost-Effectiveness. Is the project necessary? For acquisition projects, what protection do current land use regulations afford? For habitat restoration projects, over what time frame will recovery of targeted biological or physical functions occur if we do nothing?) Does applicant quantify benefit (i.e. miles and quality of habitat upstream of a fish blocking culvert)? Has a cost/benefit been calculated? Does applicant provide match/leveraging of additional funds and at what level?

Coordination with other efforts. Are assessments complete? What previous projects have been conducted in the sub-drainage? Is there a sub-basin recovery plan in place and does it integrate well with other land management activities? To what extent does applicant incorporate existing technical information (e.g. watershed analyses)?

Social and political context. To what extent does project include community-based employment (especially dislocated natural resource workers), stakeholder partnerships, and public outreach and education?

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ATTACHMENT A

WRIA 1 Lead Entity Supplemental Application Questions

The Ranked Elements section of the Interim Restoration Strategy contains additional questions that are necessary to evaluate project viability and relative priority within WRIA 1. It should be noted that the questions under the Ranked Elements section overlap in part with the SRF Board Evaluation Questions. In order to avoid redundant application questions, additional responses beyond the required SRFB questions are not required. **However, applicants should read and incorporate the information required of the Ranked Elements into the Evaluation questions required by the SRFB. These responses will serve as the basis for local scoring the of Ranked Elements and for the Lead Entity response to the SRFB regarding project specific questions.** Failure to incorporate these elements into responses to Evaluation questions will result in a lowered score or no rank for the application.

ATTACHMENT B

WRIA 1 Lead Entity Screening Ranking Matrix and Instructions

To be used for SRFB Grant Applications {the attached excel spreadsheet contains the actual scoring matrix}

Instructions for Using the Ranking Matrix

Project Type:

Mark the project type on the ranking matrix. Has the applicant provided documentation clearly indicating that the proposed project is eligible for SRFB funding?

Threshold Elements

Verify that the application has clearly and fully answered the threshold questions. Has the applicant provided clear and convincing justification for projects with a legal obligation?

Evaluation Questions

Each applicant is required to fully answer each of the evaluation questions in the SRFB application form for each project proposal. These responses will be considered in the scoring of the Core Evaluation questions and in the Ranked Elements below.

Ranked Elements

It is expected that the applicants will address the questions identified under the Ranked Elements (see page 11 above) in the Core Evaluation responses. The reviewers will score the Ranked Elements based on the responses provided for Core Evaluation questions.

ATTACHMENT C

WRIA 1 SALMON RECOVERY RESOURCE LIST

Numerous non-profit and governmental organizations are currently working cooperatively in watershed and salmon recovery within Water Resource Inventory Area 1. The listing below is intended to help guide members of the community that are interested in salmon recovery towards available resources. This does not constitute an endorsement of any group on the part of Whatcom County. The list may not reflect all the groups currently active.

Non-profit Organizations

1. *Nooksack Recovery Team* P.O. Box 28598 Bellingham, WA 98228-0598 (360) 319-0628 Pat Smith, Board President	2. *Nooksack Salmon Enhancement Association* 2445 E. Bakerview Rd. Bellingham, WA 98226 (360) 715-0283 (360) 715-0282 (fax) Wendy Scherrer, Executive Director
3. *People for Puget Sound* 407 Main Street, Suite 201 Mt. Vernon, WA 98273 (360) 336-1931 (360) 336-5422 (fax) Britta Eschete, Outreach Coordinator	4. *Skagit Watershed Council* 407 Main Street, Suite 205 Mt. Vernon, WA 98273 (360) 419-9326 Shirley Solomon, Executive Director

Government Agencies

1. *City of Bellingham* Department of Public Works Environmental Resources Division 2221 Pacific Street Bellingham, WA 98226 (360) 676-6850 (360) 676-7799 (fax) Clare Fogelsong, Superintendent	2. *Lummi Nation* Natural Resources Department 2616 Kwina Road Bellingham, WA 98226 (360) 384-2267 (360) 384-4737 Merle Jefferson, Executive Director Jim Hansen, Restoration Coordinator
3. *Nooksack Tribe* Natural Resources Department P.O. Box 157 Deming, WA 98244 (360) 592-2632 (360) 592-5753 (fax) Bob Kelly, Director Paul Pittman, Restoration Coordinator	4. *United States Forest Service* Mt. Baker-Snoqualmie National Forest Mt. Baker District 2105 State Route 20 Sedro Woolley, WA 98284-9393 (360) 856-5700 Jon Vanderheyden, District Ranger
5. *Washington State Department of Ecology* Nooksack Field Office 1204 Railroad Avenue, Suite 200 Bellingham, WA 98225 (360) 738-6250	6. *Washington State Department of Fish and Wildlife* Watershed Stewardship Team (360) 676-2003 Steve Seymour, Fisheries Biologist

Mark Henderson, Water Quality Specialist	
7. *Washington State University Cooperative Extension* 1000 N. Forest Street, Suite 201 Bellingham, WA 98226 (360) 676-6736 (360) 738-2458 (fax) Craig MacConnell, Extension Faculty, Chair	8. *Whatcom Conservation District* 6975 Hannegan Road Lynden, WA 98264 (360) 354-2035 (360) 354-4678 (fax) George Boggs, District Manager
9. *Whatcom County Department of Public Works Water Resources Division* 322 N. Commercial St, Suite 110 Bellingham, WA 98226 (360) 676-6876 (360) 738-2468 (fax) John N. Thompson, ESA Coordinator	

Citizen Committees

1. *Marine Resources Committee* Whatcom County Water Resources Division 322 Commercial St, , Suite 110 Bellingham, WA 98225 (360) 676-6876 (360) 738-2468 (fax) Bruce Roll, Water Resources Division Manager	2. *Salmon Habitat Restoration Citizen Advisory Committee* Whatcom County Water Resources Division 322 Commercial St., Suite 110 Bellingham, WA 98225 (360) 676-6876 (360) 738-2468 (fax) John N. Thompson, ESA Coordinator

ATTACHMENT D

PRELIMINARY ANNOTATED BIBLIOGRAPHY OF EXISTING INFORMATION: WRIA 01, NOOKSACK BASIN

Prepared by Treva A. Coe
Natural Resources Department
Nooksack Indian Tribe

I. General Stock Inventories and Fish Distribution

Year	Topic	Reference
1994	Stock Inventories	**SASSI. 1994.** Salmon and steelhead stock definitions, distribution, abundance and status.
1998	Stock Inventories	**SASI. 1998.** Bull trout/native char stock definitions, distribution, abundance and status.
2000	Stock Inventories	**SASI. 2000.** Coastal cutthroat stock definitions, distribution, abundance and status.
1999	Spawner Surveys	**WDFW. 1999. Spawner survey database.** Collection of spawner survey data for WRIA 1, concentrating on chinook but with other species.
2000	Species Periodicity	**Anchor Environmental, LLC. 2000. Nooksack Periodicity Charts.** Residence timing in river by species and life history stage for spring chinook, fall chinook, coho, chum, pink, sockeye, summer and winter steelhead, and coastal cutthroat and bull trout (native char).
2000	Fish Distribution	**NWIFC. 2000. Fish distribution map.** Distribution of salmonid stocks in Nooksack Basin.
1921	Fish Distribution, Historical	**Norgore, M., and A.W. Anderson. 1921. Report on a Biological Survey of the Nooksack River during the Summer of 1921. Washington Department of Fish and Wildlife?** Report of surveys of various streams in upper watershed, including potential and actual salmonid utilization.
1931	Fish Distribution, Historical	**WDF. 1931. Outline of Biological Survey for the Seasons of 1929 and 1930, Illustrating the Extent of the Survey with a Summary of that Portion of Stream Area Surveyed Available to Spawning Salmon and also the Stream Area Affected by Vertical Obstructions. Pages 136-145. Fortieth and Forty-First Annual Reports, Division of Fisheries.** Historical abundance of fish in selected tribs.

1943	Fish Distribution, Historical	**1943. Nooksack River System.** Short description of Nooksack system from anadromous fish perspective.
2000	Fish Distribution, Potential (also referenced under Habitat Assessment)	**Currence, N. 2000. Middle Fork Nooksack Anadromous Salmonid Potential Upstream of the Diversion Dam. Natural Resources Department, Nooksack Indian Tribe. Deming, WA.** Summary of existing information on anadromous salmon and trout potential use of Middle Fork upstream of diversion dam.
1999	Riverine Sockeye	**Distribution and population genetic structure of river- and sea-type sockeye salmon in western North America. Ecology of Freshwater Fish 8: 181-193.** Describes occurrence and genetics of riverine-spawing sockeye in 11 rivers in western Washington, including Nooksack River.

II. Watershed Conditions

2000	Watershed, General	**NWIFC. 2000. SSHIAP.** Stream segmentation of Nooksack Basin.
1993	Watershed, general	**Fox, S., and J. Greenberg. 1993. Hydrologic and Fisheries Resources of the Nooksack Basin. Whatcom County Planning Department, Bellingham, WA. July 1993.** Paper and field inventory of rivers, streams, ditches; fish species extent and critical fish habitat areas, and past and potential fish habitat restoration sties in the Nooksack Basin.
1975	Watershed, general	**Phinney, L.A., and R.W. Williams. 1975. A catalog of Washington streams and salmon utilization. Volume 1, Puget Sound region. Wash. Dept. of Fisheries. Olympia, WA.** • Inventory of streams and generalized habitat characteristics, salmon utilization, and limiting factors. • Geographic Scope: WRIA 01
1960	Watershed, general	**DOC. 1960. Water Resources of the Nooksack River Basin and Certain Adjacent Streams. Water Supply Bulletin No. 12. Division of Water Resources, Washington Department of Conservation. Olympia, WA.** General description of watershed, climate, economics, geology, surface water resources, water quality, water use.
2000	Riparian	**Duck Creek Associates. 2000. Nooksack Riparian Function Assessment.**
2000	Water Quality	**EPA, 2000. 303d Listed Waters. Available from http://www.epa.gov/iwi/303d/17110002_303d.html** • Temperature, DO, fecal coliform, pH, heavy metals, other pollutants, etc.
1996	Water Quality	**Dorf, G. 1996. Watershed Approach to Water Quality Management: Needs Assessment for the Nooksack Watershed, WRIA 1. Water Quality Program, Washington Department of Ecology, Olympia, WA.** Review of existing surface and groundwater quality data and related issues.
1992	Water Quality	**Neff, D.A. 1992. A Comparison of Temperature, Dissolved Oxygen, and Turbidity Measurements in the Upper Watershed of the Nooksack River to Washington State Water Quality Standards. Technical Report #93-02. Lummi Fisheries,**

		Bellingham, WA. March 29, 1992. Review of temperature, do, and turbidity measurements for Nooksack River upper watershed.
1992	Floodplain	**Bertschi, R. 1992. Channel Changes and Flood Frequency on the Upper Main Stem of the Nooksack River, Whatcom County, Washington. M.S. Thesis?, Western Washington University, Bellingham, WA.** Cited in Fiscus 1994: Historic channel patterns, changes in channel cross sections, particle size distribution of the channel depostis between Everson and Deming, and comparison of lood frequencies derived by two widely used methods. Charts for channel cross sections show net degradation and net aggradation for years 1964-1991.
1992	Floodplain	**Caplow, F., and T. Plake. 1992. Wetlands in the Nooksack River Floodplain. Whatcom County Environmental Resources Report Series. Whatcom County Planning Department. Bellingham, WA.** Includes description of watershed and floodplain, history of land use, reach descriptions, "paper" wetlands inventory, floodplain functions, description of wetlands and flooding, wetlands in active channel of Nooksack river.
199?	Floodplain	**Gersib, D. Puget Sound Wetland Restoration Project. Department of Ecology.** Not examined; referenced in Preliminary Resource Documentation for a Nooksack River Basin Historic Conditions Study, Watershed Professionals Network, 1999.
199?	Floodplain	**Gersib, D. River Basin Characterization Project. Department of Ecology.** Not examined; referenced in Preliminary Resource Documentation for a Nooksack River Basin Historic Conditions Study, Watershed Professionals Network, 1999.
Pending	Floodplain (also referenced under Historical, Floodplain)	**Collins, B. Pending. Historical channel and floodplain conditions assessment. Expected early 2001.** Reconstruction of historical conditions for channel and floodplain from archival sources, as well as analysis of incremental human impacts.
1986	Others pertaining to Lower Watershed	**Whatcom Conservation District. 1986. Agricultural Impacts on Water Resources in Tenmile Watershed, Whatcom County, Washington. Prepared for Lummi Tribal Fisheries Department, Bellingham, WA. May 31, 1986.** Watershed description, Inventory of resources (land use, salmonid, water quality), conclusions. includes fine sediment, juvenile sampling, temperatures, do, other water

		quality parameters, other kinds of data.
1999	Historical	**Watershed Professionals Network LLC. 1999. Preliminary Resource Documentation for a Nooksack River Basin Historic Conditions Study. Prepared for Whatcom Conservation District. July 31, 1999.**
1982	Historical, Floodplain	**DiDomenico, A.T. 1982. Vegetation Pattern at the Time of American Settlement in the Nooksack River Lowland, Northern Puget Trough, Whatcom County, Washington. M.S. Thesis, Western Washington University, Bellingham, WA.**
Pending	Historical, Floodplain (also referenced under Floodplain)	**Collins, B. Pending. Historical channel and floodplain conditions assessment. Expected early 2001.** Reconstruction of historical conditions for channel and floodplain from archival sources, as well as analysis of incremental human impacts.
1999	Watershed Analysis	**Crown Pacific Limited Partnership. 1999. Acme Watershed Analysis. Prepared for Department of Natural Resources, Forest Practices Division, Olympia, WA.** • Acme watershed overview, Mass Wasting, Surface Erosion, Hydrologic Change, Channel Assessment, Riparian Function, Fish Habitat, Public Works • Geographic Scope: Acme WAU
1998	Watershed Analysis	**DNR. 1998. Hutchinson Watershed Analysis. Washington Department of Natural Resources, Sedro-Woolley, WA.** • Mass Wasting – geological/geomorphological overview; types of mass wasting; mass wasting inventory (aerial photos 1943-1995) • Surface Erosion – watershed overview; subbasin delineation; preliminary surface erosion potential map (based on slope, field observations, soil characteristics (k); field erosion observations; road erosion • Hydrologic Change – current watershed conditions (descriptive), historic trends in watershed condition (streamflow records), water available for runoff, peak flows, potential impacts to public resources, peak flow hazard calls • Riparian Function – early riparian history from aerial photographs and field visits; large woody debris, canopy closure, stream temperature • Stream Channels – watershed overview; stream channel partitioning; historic conditions; current

		conditions (including geomorphic unit descriptions) • Fish Habitat – fish presence; salmonid life histories; salmonid status and abundance; habitat analysis by life stage (including culverts); summary of habitat concerns by geomorphic unit • Public Works • Geographic Scope: Hutchinson WAU
1996	Watershed Analysis	**DaPaul, Inc., and Trillium Corp. 1996. Warnick Watershed Analysis. Submitted to Department of Natural Resources, Northwest Region, Sedro-Woolley, WA.** • Overview of watershed • Mass Wasting – includes landslide inventory, slope stability map units, sensitivity to forestry activities • Hydrology, Surface erosion (hillslope and road surface); Stream Channel Assessment; Riparian Function; Public Works; Synthesis/conclusions • Fish Habitat – relative abundance and status of stocks; habitat condition (largely subjective table of pool %, pool freq, lwd, substrate, off-channel habitat, holding ools, fines, spawning habitat, access, scour potential) • Geographic Scope: Warnick WAU
1995	Watershed Analysis	**USFS. 1995. Pilot Watershed Analysis for Canyon Creek, Mt. Baker-Snoqualmie National Forest. USDA Forest Service, Mt. Baker –Snoqualmie National Forest, Mt. Baker Ranger District. Sedro-Woolley, WA.** • Introduction, Settings, and Issues • Watershed Conditions – Past and Present – description of current and future harvest history, climate, geology, soil and soil erosion, mass wasting (estimate of sediment contribution), current and potential vegetation, fire history, vertebrate biology, hydrology, channel conditions, water quality, aquatic species occurrence and relative abundance, current and potential aquatic conditions • Others - Species of Viability Concern (includes discussion of pool quality and lwd , Commodities and Values, Ecosystem health and viability, major findings and potential future conditions, identified problems and restoration opportunities, needs, monitoring and future analysis, ecosystem health and viability • Geographic Scope: Canyon Creek WAU
1995	Watershed Analysis	**USFS. 1995. Watershed Analysis North Fork Nooksack River. USDA Forest Service, Mt. Baker –**

		Snoqualmie National Forest, Mt. Baker Ranger District. Sedro-Woolley, WA. • Introduction – watershed overview • Watershed Issues, key questions • Past and Current conditions (numerous maps from GIS analysis?) - describing classification of vegetation series and seral stages, fire history, fragmentation and harvest history, range of natural variability, plant associations, sensitive species • Aquatic system (largely descriptive)– landform description; sedimentation (including estimates of sediment sources); mass wasting and surface erosion; stream channels description; flooding; wetlands; water quality; anadromous fish barriers; refugia; channel morphology and sediment/debris transport processes; large wood; fish habitat limitatations; species and status • Condition trends, fx of potential future land mgmt (descriptive) – includes flooding/peak flows; sediment delivery; channel morphology; lwd recruitment; water quality; fish habitat and stocks at risk • Geographic Scope: "North Fork" WAU
199?	Watershed Analysis	**Skookum Watershed Analysis** Geographic Scope: Skookum WAU
1998	Landslide Inventory	**Watts, W.M. 1998. Middle Fork Nooksack River Sediment Reduction Plan, Part II: Preliminary Upslope Erosion and Channel Assessment. Prepared for Lummi Natural Resources Department, Bellingham, WA. June 1998.** Inventory of landslides in Middle Fork watershed, with identification of mass wasting sources, relative magnitude, and sediment delivery to streams. Variations in Middle Fork channel also recorded and analyzed. Incorporated into GIS.
1997	Landslide Inventory	**Watts, W.M. 1997. North Fork Nooksack River Watershed: Preliminary Upslope Erosion Assessment. Prepared for Lummi Natural Resources Department, Bellingham, WA. July 1997.** Inventory of landslides in North Fork watershed, with identification of mass wasting sources, relative magnitude, and sediment delivery to streams. Incorporated into GIS.

1996	Landslide Inventory	**Watts, W.M. 1996. South Fork Nooksack River Watershed: Preliminary Upslope Erosion Assessment. Prepared for Lummi Natural Resources Department, Bellingham, WA. April 1996.** Inventory of landslides in South Fork watershed (excludes Acme WAU), with identification of mass wasting sources, relative magnitude, and sediment delivery to streams. Incorporated into GIS.
1998	Road Inventory	**Zander, A. 1997. Middle Fork Nooksack River Sediment Reduction Plan, Part I: Road Inventory. Final Report to Lummi Natural Resources Department, Bellingham, WA. June 1998.** Mapping, activity level and current condition of forest roads in Middle Fork watershed; mapping of forest land ownerships, landslides, and other erosion and sediment sources. Incorporated into GIS.
1997	Road Inventory	**Zander, A. 1997. Road Inventory for the North Fork Nooksack River Watershed. Final Report to Lummi Natural Resources Department, Bellingham, WA. July 1997.** Mapping, activity level and current condition of forest roads in North Fork watershed; mapping of forest land ownerships, landslides, and other erosion and sediment sources. Incorporated into GIS.
1996	Road Inventory	**Zander, A. 1996. Road Inventory for the South Fork Nooksack River Watershed. Final Report to Lummi Natural Resources Department, Bellingham, WA. April 1996.** Mapping, activity level and current condition of forest roads in South Fork watershed (excludes Acme WAU); mapping of forest land ownerships, landslides, and other erosion and sediment sources. Incorporated into GIS.
1999	Others pertaining to Upper Watershed	**Soicher, A. 1999. Acme Watershed Monitoring Program, Phase 1 – Assessing the Effectiveness of Mass Wasting Prescriptions in the Acme Watershed. Evergreen Land Trust, Van Zandt, WA. Draft Final Report, March 20, 1999.** Includes mass wasting buffer monitoring plot data, landslide inventory.
1997	Others pertaining to Upper Watershed	**Zitkovich, J., and D. Weeks. 1997. Anderson Creek Slide Survey. Nooksack Salmon Enhancement Association, Bellingham, WA.** Inventory of slides in Anderson Creek drainage, with photos and characteristics.
1995	Others pertaining	**Osbaldiston, R. 1995. Inventory of Mass Wasting**

	to Upper Watershed	**Units and River Tributaries Along the South Fork of the Nooksack River. Crown Pacific, Hamilton, WA.** Inventory of all the sources of sediment along the South Fork of the Nooksack River from Cavanaugh to Wanlick.
1986	Others pertaining to Upper Watershed	**Peak Northwest. 1986. Nooksack River Basin Erosion and Fisheries Study. Prepared for Lummi Tribal Fisheries Department. Bellingham, WA. October 1986.** Identification of sediment sources and opportunities for reduction of sediment input to streams. Boulder Creek, Canyon Creek, Cornell Creek, Howard Creek, Racehorse Creek.
1970	Others pertaining to Upper Watershed	**Smelser, C.R. 1970. Sequent Occupance of the Nooksack River Valley and the Influence of Man on the Rate of Sediment Delivery to Bellingham Bay. M.S. Thesis. Western Washington University, Bellingham, WA.**
1985	Instream Flows	**Nelson, C. 1985. Nooksack Instream Resources Protection Program. Department of Ecology, Olympia, WA.**
Pending	Instream Flows	**Hardy et al., Utah State University, pending. Assessment of water quantity, water quality, and instream flows for WRIA 1.** Data collected for instream flow assessment during 2000 field season included detailed bathymetry and current velocity profiling, mapping of habitat units and cover, and macroinvertebrate sampling at 14 representative sites throughout the WRIA 1.
2000	Estuarine	**USACOE. 2000. Nooksack River Estuary Project, Section 22 Planning Study, Lummi Indian Reservation: Final Report on Possible Restoration Alternatives. Prepared for Lummi Indian Nation. Seattle District Corps of Engineers, Seattle, WA. June 16, 2000.** Evaluation of potential restoration projects.
2000	Estuarine/Marine	**Anchor Environmental, LLC. 2000. Biological Assessment - Chinook Salmon, Coho Salmon, Bull Trout, and Bald Eagles: Combined Remedial Action and Habitat Enhancement for the Georgia-Pacific Log Pond, Whatcom Waterway, Bellingham. Prepared for Georgia-Pacific, Bellingham, WA. March 20, 2000.** Applies to specific project site.
1999	Estuarine/Marine	**Anchor Environmental, LLC. 1999. Bellingham Bay Comprehensive Strategy Draft Environmental Impact Statement. Prepared for Washington Department of**

		Ecology. July 19, 1999. Includes section on affected fish and wildlife (habitat strata descriptions, biological functions of existing habitat, estuarine/marine habitat, fisheries resources).
1999	Estuarine/Marine	**Anchor Environmental, LLC. 1999. Bellingham Bay Demonstration Pilot - Sediment Site and Source Control Documentation Report. Prepared for Bellingham Bay Demonstration Pilot Work Group, Bellingham, WA. July 30, 1999.**
1999	Estuarine/Marine	**Norris, J.G., S. Wyllie-Echeverria, M. Buchert, C.D. Young, and T. McKenzie. 1999. Underwater Videographic Eelgrass Survey, Bellingham Bay Demonstration Pilot Project, August 3-5, 1999. Prepared for Pacific International Engineering, Edmonds, WA. October 25, 1999.** Delineation of eelgrass beds in the urbanized region of Bellingham Bay from I and J waterway to the south end of Boulevard Park.
1999	Estuarine/Marine	**Pacific International Engineering and Anchor Environmental. 1999. Bellingham Bay Demonstration Pilot Project: Final Data Compilation and Analysis. Prepared for Bellingham Bay Demonstration Pilot Work Group, Bellingham, WA. March 17, 1999.** Includes physical and built environment, and chemical and biological characteristics of Bellingham Bay.
1997	Nearshore Marine	**DOE. Marine Waters Monitoring Program. Available from DOE, Olympia, WA.** • Temperature, salinity, specific conductivity, secchi disk depth, oxygen, pH, nutrients, pigments, fecal coliform in stations in Bellingham Bay.

III. Chinook Studies

1999	Population	**Castle, P. 1999. North Fork Natural Spring Chinook Production. Unpublished data. Washington Department of Fish and Wildlife. La Conner, WA.** Tally of natural vs. cultured origin of spawners recruiting to North Fork spawning grounds and assignment to brood year; calculation of natural recruit/spawner.
1999	Population	**Castle, P. 1999. SASSI Stock Escapement Estimates for the Nooksack and Samish Basins.**

		Unpublished data. Washington Department of Fish and Wildlife. La Conner, WA. SASSI escapement estimates for 1967-1999.
1998	Population	**Kirby, G. 1998. Population Biology. Draft Report.** Summarizes existing population information including basin overview, genetic relationships of nooksack basin chinook, upstream migration, spawning distribution and timing, escapements, spawn age and fecundity, stream residence and outmigration, ocean distribution, distribution of no-mark carcass recoveries.
1985	Population	**MacKay, M. 19??. Estimating the 1985 Nooksack Spring Chinook Escapement using a "Reverse Peterson" Mark and Recapture Method. Lummi Indian Tribe, Bellingham, WA.**
1999	Chinook, Limiting factors	**Morgan, A., ed. 1999. Habitat Factors Contributing to the Decline of Puget Sound Chinook. Northwest Indian Fisheries Commission, Olympia, WA. December 14, 1999, draft.** Generalized summary of factors limiting Puget Sound Chinook.
1996	Chinook, Limiting factors	**Neff, D., R. Vanderhorst, and S. Bishop. 1996. Nooksack River Basin – Native Chinook. Pages 56 – 62 *in* S. Bishop and A. Morgan, eds. 1996. Critical Habitat Issues by Basin for Natural Chinook Stocks in the Coastal and Puget Sound Areas of Washington State. Northwest Indian Fisheries Commission, Olympia, WA.** General limiting factors for Nooksack chinook.
1990	Chinook, Limiting Factors	**Dunphy, G.S. 1990. Local Activities Influencing The Success and Abundance of Fisheries Resources of the Nooksack River System in the South Fork Valley and Vicinity. Lummi Fisheries, Bellingham, WA. October 25, 1990, draft.** General description of impacts and limiting factors in South Fork.
1987	Chinook, Limiting Factors	**Doughty, K. (ed). 1987. Nooksack River Spring Chinook Technical Report. Nooksack Spring Chinook Technical Group (Nooksack Tribe, Lummi Tribe, WDF, USFWS).** • Description of watershed • Historical fisheries • Biological review - includes radio tagging

		studies, juvenile sampling study, distribution, timing, abundance, population estimates, population indices, size, age and electrophoretic information • Enhancement activities • Habitat - includes potential limiting factors, environmental problems (sedimentation, temperature, pollution, stream flows), current and future habitat research • **Geographic Scope: Nooksack River watershed**
2000	Genetics, Chinook	**Young, S.F., and J.B. Shaklee. 2000. Non-Lethal Stock-of-Origin Assignment of Nooksack Basin Chinook Salmon Smolts Using Microstatellite DNA Markers: Phase I. Genetics Laboratory, Washington Department of Fish and Wildlife, Olympia, WA. July 2000.** Describes accuracy associated with three baselines plus stock assignment of 121 smolts from lower river smolt trap**.**
1999	Genetics, Chinook	**Shaklee, J.B., and S.F. Young. 1999. Non-Lethal Stock Discrimination of Nooksack Basin Chinook Salmon Using Microsatellite DNA Markers: A Pilot Study. Genetics Laboratory, Washington Department of Fish and Wildlife. Olympia, WA. January 31, 1999.** Describes development of, and differentiation among, baselines for the 3 recognized Nooksack chinook stocks.
1994	Genetics, Chinook	**Marshall, A. 1994. Chinook Populations in the Nooksack Basin - genetic baseline analysis. Memorandum, April 26, 1994. Planning, Research and Harvest Management, Washington Department of Fish and Wildlife, Olympia, WA.** Analysis and interpretation of new genetic baseline data, plus comparative analysis among new and old data for 3 Nooksack chinook populations.
1981	Chinook, Holding/Upstream Migration	**Barclay, M. 1981. Second Year Radio-Tagging Study and First Year Mark and Recovery Study of Nooksack Spring Chinook. Nooksack Tribal Fisheries, Deming, WA.** Upstream migrating and holding fish were radio-tagged and disc-tagged and tracked.
1980	Chinook, Holding/Upstream Migration	**Barclay, M. 1980. Radio-Tagging Study of Nooksack Spring Chinook. Nooksack Tribe, Deming, WA.**

1988	Chinook, Holding/Spawning	**Schuett-Hames, D. and J., M. MacKay, K. Doughty, and P. Wampler. 1988a. An Assessment of the Availability and Quality of Spring Chinook Holding and Spawning Habitat in the South Fork Nooksack River, 1986. Lummi Tribal Fisheries Department, Bellingham, WA; Nooksack Tribal Fisheries Department, Deming, WA; and Fisheries Assistance Office, U.S. Fish and Wildlife Service. Olympia, WA. June 1988.** Assessment of spring chinook holding and spawning habitat in the South Fork and the environmental factors affecting habitat quality and quantity. Includes inventory of holding sites (with depth, area, volume, cover, # fish), spawning sites (defined by suitable depth, velocity, substrate), fine sediments, stream stability, water temperature, and discussion of limiting factors.
1999	Chinook, Spawning	**MacKay, M. 1999 Nooksack Chinook Spawner Surveys Results and Implications for DNA Analysis. December 16, 1999, Memorandum to NEAT Administrative Committee. Lummi Natural Resource Department, Bellingham, WA.** Description of location of 1999 redd sightings in lower mainstem from RM 17-30; also redds documented from Lynden to Nugents Corner from float surveys.
1987	Chinook, Spawning	**Schuett-Hames, D. and J. 1987. North Fork Spring Chinook Surveys: 1986 Survey Results, A Historical Count Review, and Habitat Observations. Fisheries Assistance Office, U.S. Fish and Wildlife Service, Olympia, WA; Lummi Tribal Fisheries Department, Bellingham, WA. March 1987.** Report of 1986 spawner surveys for North Fork, comparison with historical counts, and discussion of current habitat conditions.
1988	Chinook, Spawning/Incubation	**Schuett-Hames, D. and J., and P. Stevenson. 1988b. North Fork Nooksack Spring Chinook Surveys: 1987 Survey and Redd Survival Results. Fisheries Assistance Office, U.S. Fish and Wildlife Service. Olympia, WA. August 1988.** Includes spawning ground surveys, redd survival surveys (channel cross-sections and redd elevation monitoring) in North Fork.
1988	Chinook,	**Schuett-Hames, D.E and J.P., and D. Mike.**

	Spawning/Incubation	**1988c. Nooksack Basin and Associated Drainages: Stream Monitoring Data - 1982 to 1987. Lummi Tribal Fisheries Department, Bellingham, WA. March 1988.** Compilation of stream stability indices, fine sediments, cross section data, redd scour results for Anderson, Baker, Bell, Bertrand, Boulder, Boyd, Canyon, Canyon Lake, Coal, Cornell, Deadhorse, Deer, DoubleDitch, Edfro, Fishtrap, Gallup, Hedrick, Howard, Hutchinson, Kamm, Kenney, Maple, North Fork, Padden, Porter, Racehorse, South Fork, Silver, Skookum, Squalicum, Tenmile, Thompson, Whatcom Creeks.
2000	Chinook, Juvenile Rearing	**Nooksack Tribe. 2000. Unpublished YR 2000 Smolt trap data.**
1996	Chinook, Juvenile Rearing	**Castle, P., and D. Huddle. 1996a. South Fork Nooksack Spring Chinook Fry Survey. Internal Report. Washington Department of Fish and Wildlife, Mill Creek, WA.**
1996	Chinook, Juvenile Rearing	**Castle, P., and D. Huddle. 1996b. Recent Washington Department of Fish and Wildlife field activities related to wild juvenile spring Chinook in the Nooksack River. Internal Report. Washington Department of Fish and Wildlife, Mill Creek, WA.**
1995	Chinook, Juvenile Rearing	**Castle, P., and D. Huddle. 1995. Spring Chinook Fry Surveys in the Nooksack River Basin. Internal Report. Washington Department of Fish and Wildlife, Mill Creek, WA.**
1994	Chinook, Juvenile Rearing	**Castle, P., and D. Huddle. 1994. South Fork Nooksack River Spring Chinook Fry Capture Study and 1994 Habitat Reconnaissance. Internal Report. Washington Department of Fish and Wildlife, Mill Creek, WA.**
1983	Chinook, Juvenile rearing	**Wunderlich, R.C., and R. Boomer. 1983. Nooksack River Juvenile Spring Chinook Salmon Investigations - 1982. U.S. Fish and Wildlife Service, Fisheries Assistance Office, Olympia, WA.**
1982	Chinook, Juvenile rearing	**Wunderlich, R.C., J.H. Meyer, R.S. Boomer. 1982. Nooksack River Juvenile Spring Chinook Salmon Investigations. Fisheries Assistance Office, U.S. Fish and Wildlife Service, Olympia, WA. April 1982.** Mark and release in upper north and south forks of

		wild chinook fry. Also, monitoring of fin-clipped (and microtagged) Skookum hatchery spring chinook fry releases.
2000	Chinook, Outmigration	**Conrad, R.H., and M.T. MacKay. 2000. Use of a Rotary Screwtrap to Monitor the Outmigration of Chinook Salmon Smolts from the Nooksack River: 1994-1998. Northwest Fishery Resource Bulletin, Project Report Series No. 10. Northwest Indian Fisheries Commission, Olympia, WA; Lummi Natural Resources Department, Bellingham, WA.** Summary of first 5 years of operation for Lummi smolts trap, including estimates of capture efficiency, indices of relative abundance, etc.
2000	Chinook, Outmigration	**Lummi Natural Resources. 2000. Unpublished YR 2000 Smolt trap data.**
1964	Nearshore Marine	**Tyler, R.W. 1964. Distribution and Migration of Young Salmon in Bellingham Bay, Washington. Circular No. 212. Fisheries Research Institute, College of Fisheries, Univeristy of Washington, Seattle, WA.** Sampling of juvenile salmon in Bellingham Bay with tow net, beach seine, fyke net during April, May and June 1963.
1968	Nearshore Marine	**Sjolseth, D.E., E.O. Salo, R.A. Bishop, and W.G. Williams. 1968. Studies of Juvenile Salmon in the Nooksack River System and Bellingham Bay. Fisheries Research Institute, College of Fisheries, University of Washington, Seattle, WA. September 20, 1968.** Includes studies of coho salmon in Thompson, Maple and Anderson Creeks during summer 1966; studies of salmon in Bellingham Bay - mark and release of hatchery fall fish then recovery by tow-netting in Bellingham Bay (length frequencies indicate all chinook hatchery falls); also took water quality during sets.
1995	Nearshore Marine	**Ballinger, D., and R. Vanderhorst. 1995. Predation on Chinook Smolts in Georgia Strait. Lummi Indian Business Council, Bellingham, WA. March 1995 Draft.** Sampling of dogfish and juvenile salmon in nearshore marine habitat from Bellingham Bay to Canadian border.

IV. Other Studies (Smaller Scale)

198?	Habitat Surveys	**WDFW. 1979. Habitat surveys for Middle Fork Nooksack.** Cursory habitat surveys for tribs of Middle Fork.
198?	Habitat Surveys	**WDFW. 1979. Habitat surveys for South Fork Nooksack.** Cursory habitat surveys for tribs of South Fork.
1979	Habitat Surveys	**WDFW. 1979. Habitat surveys for Main Fork Nooksack.** Cursory habitat surveys for tribs of lower mainstem.
1981	Habitat Surveys	**WDFW. 1981. Habitat surveys for North Fork Nooksack.** Cursory habitat surveys for tribs of North Fork.
1993	Biotic Integrity	**Talayco, N. 1993. A Preliminary Assessment of the Aquatic Insect Populations in Two Tributaries of the South Fork of the Nooksack River, Whatcom County, Washington. Report to Nooksack Indian Tribe, Deming, WA. March 12, 1993.** Sampled macroinverts at Todd Creek confluence, Middle Ditch, Hardscrabble Creek.
1999	Habitat Surveys	**Nooksack Salmon Enhancement Association. 1999. Stream Monitoring: Habitat Assessment Survey - Squalicum Creek, Dakota Creek, Bertrand Creek, Kamm Creek. Bellingham, WA.** Stream survey data and summary report.
2000	Habitat Assessment (also referenced under Fish Distribution, Potential)	**Currence, N. 2000. Middle Fork Nooksack Anadromous Salmonid Potential Upstream of the Diversion Dam. Natural Resources Department, Nooksack Indian Tribe. Deming, WA.** Summary of existing information on anadromous salmon and trout potential use of Middle Fork upstream of diversion dam.

ATTACHMENT E

Salmon Recovery Funding Board Third Round Grant Cycle, 2001/2002

WRIA 1 Lead Entity Application Timelines

SRFB Timeline/Task	***Proposed WRIA 1 Timeline/Task***
July 2001/ Applications available	**March 6, 2001**/Land acquisition ad hoc coordination meeting at Water Resources
July 10, 2001/ Applicant workshop, Bellingham	**June 26**/Preliminary project concept & coordination meeting at Water Resources
September 30, 2001/Letter of intent to SRFB	**July 10**/ Applicant workshop, 9-11 AM at 1000 North Forest, Bellingham
July/November 2001/Technical Panel meetings	**July - October**/ Project coordination via CHC meetings/correspondence & NRT monthly meetings
July/November 2001/Lead Entity application evaluation	**August 15**/ Timelines finalized
November 30, 2001/LE project lists and applications due	**August 24/** Updated strategy available
December 3, 2001-January 18, 2002/Staff application review	**September 24**/Letter of intent due to Lead Entity. CHC and JTAG given "heads-up" **September 30**/Letter of Intent due to SRFB (package from Lead Entity)
February 11-21, 2002/Technical Panel review	**October 12, 2001**/***Applications due by close of business*** (5PM) at: Whatcom County Water Resources Division, 322 N. Commercial St, Suite 110, Bellingham, Washington 98225
February 22-28, 2002/LE response to Tech Panel	**October 17**/Copies of applications delivered to citizens committee and technical group
March 1-8, 2002/Tech Panel draft report	**October 17**/Meet with SRFB Tech Panel - informational session on watershed condition, fish stocks, strategy, data needs, & projects,

	etc.
March 9-15, 2002/LE Review draft report	**October 23 & 24/** Applicant presentations to citizen committee and technical group
March 16-22, 2002/Technical Panel final report	**October 30/31 -** Joint Technical Advisory Group meets to review applications, draft technical recommendations
March 22-28, 2002/ Staff prepares SRFB materials	**November 7/** JTAG technical review & ranking reports due to Lead Entity, distributed to citizen committee
March 29-April 17, 2002/Public comment period	**November 13 & 14/** CHC meets to finalize ranking; technical group available for consultation
April 18-19, 2002 (tentative)/SRFB allocates funding	**By November 30/** LE finalizes application package including final ranked project list, applications, supporting documents, and Joint Board letter of support
April, May, June 2002/Successful applicant workshops and issue project agreements	**February 11-21, 2002/** Coordinated presentation of application package before SRFB technical panel
	February 22-28, 2002/LE response to Tech Panel due.
	See SRFB schedule at left for remaining steps